Environmental Science and Policy 96 (2019) 1–8

Contents lists available at ScienceDirect

Environmental Science and Policy

journal homepage: www.elsevier.com/locate/envsci

Implications of emergent risk for application of risk transfer mechanisms by local governments in Queensland

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ARTICLE INFO

Keywords:
Climate change
Insurance
Local government
Australia
Emergent risk
Risk transfer mechanism
Risk management
Catastrophe bond

ABSTRACT

Insurance represents an integral part of local government risk management strategy. As climate change progresses, increased loss and risk related to extreme weather events such as tropical cyclones, could motivate insurers to withdraw from certain markets. In some regions, such a withdrawal represents an emergent risk that, when coupled with increasing populations and other climate change impacts, could leave local governments and ratepayers particularly vulnerable. This paper investigates such a scenario and its ramifications in the context of a region particularly vulnerable to climate change, through an exploration of the degree that consideration of emergent risks, such as loss of insurance, and the potential application of insurance alternatives influence Queensland local government risk management. The study finds little appreciation amongst government officials of emergent risk implicit in extreme weather events such as cyclones, little understanding of the nuances of risk transfer mechanisms beyond familiar traditional insurance and disaster funding mechanisms, and by default, a lack of appreciation of the relationship between the two. A lack of resource and leadership with respect to emergent risk, and an absence of dialogue between insurance brokers and local government concerning climate change risk arise as the main reasons for this result. This research is significant because it challenges current local government risk management practice through an exploration of the risks inherent in the process itself. This has potential social, economic and ecological ramifications in drawing attention to aspects of possible "uninsurability" and prospects of alleviation thereto. Further research is recommended to consider the insurance industry's part in this study's findings in order to inform current industry practice and thinking and further enlighten the causes of local government disengagement in this critical area.

1. Introduction

Local governments apply a diverse set of tools to manage the myriad of risks they face. Climate change accentuates the complexities of risk management however, potentially introducing previously inconceivable novel risk or amplifying current risks beyond existing critical levels (Preston and Stafford-Smith, 2009). These "emergent" risks may perpetuate in many forms including increased erosion from storm surges (Field et al., 2014), litigation from property developers (Macintosh et al., 2013) or, particularly salient to risk management, reduction of access to affordable insurance (Mills,2009). Historically, by enabling dissemination of such risks across broader unrelated populations and time frames, insurance has represented one critical element of their management (Kousky and Cooke, 2012). Importantly, in the context of climate change, insurance shelters communities from the financial impacts of disaster by providing them necessary resources to adapt (Arent et al., 2014).

Insurance coverage is however contingent on the ability of an insurer to balance premium affordability with cost implicit in the risk undertaken (Arent et al., 2014).Climate change threatens the viability of this ability in several ways. Firstly, research undertaken by industry participants (e.g. see Munich Re, 2014) supports global and Australian trends of rising costs from weather related disasters. As losses increase in magnitude and probability, so do costs related to an increase in risk capital that must be held by insurers to ensure regulatory solvency requirements (Clarke and Grenham, 2012).These costs can be

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https://doi.org/10.1016/j.envsci.2019.02.006
Received 2 October 2018; Received in revised form 30 January 2019; Accepted 20 February 2019
Available online 02 March 2019
1462-9011/

substantial and must be passed onto consumers, either by way of more expensive premiums or reduction or complete withdrawal of insurance coverage (Kousky and Cooke, 2012).

Secondly, as global warming perpetuates alterations to frequency, intensity and geographical incidence of climate hazards, the industry's ability to determine and price risk is severely undermined (Mills, 2005).Increased difficulty in calculating probabilities increases levels of ambiguous risk thus pushing prices up to compensate (Walker and Dietz, 2012).Price rises not only lead to reduced insurance coverage overall, as for example, households rationally forego increasingly expensive insurance (Kousky and Cooke, 2012),but they also potentially reduce company profitability and solvency through a coupling of shrinking markets and very potentially, uncorrelated natural catastrophe costs (Mills, 2009).

Recent years has seen the emergence of alternative mechanisms to traditional forms of insurance to safeguard assets and operations. Innovative products that link proactive risk reduction with premiums are appearing on the insurance landscape. Additionally, an acceptance of the viability of non-traditional risk transferal mechanisms is growing such as the use of parametric insurance (e.g. see Commonwealth of Australia: Department of Finance and Deregulation (DFD, 2012) and catastrophe bonds. Issuance of catastrophe bonds in Australia to cover Australian cyclone and US hurricane risks (InsuranceNews, 2014) and at a municipal level by the New York Mass Transit Authority to cover storm surges (Artemis, 2013), illustrate this expansion both geographically and by sector. The implications of loss of access to insurance for local government are tempered by access to and utilisation of insurance alternatives. These are both aspects of risk management that are, in the context of local government, largely unexplored.

The purpose of this paper is to investigate the degree that consideration of emergent climate change risks, such as loss of access to insurance, and the potential application of insurance alternatives, influence local government risk management. Specifically, the paper synthesises the results of six case studies of tropical cyclone-exposed local governments in Queensland. In drawing conclusions about risk management practice, the case studies explore the depth of understanding that each local government has of the range of risks that climate changed tropical cyclones expose them to, and their appreciation of the scope of mechanisms potentially available to transfer such risks. This research is significant because it challenges current local government risk management practice through an exploration of the risks inherent in the process itself. This has potential social, economic and ecological ramifications in drawing attention to aspects of possible "uninsurability" and prospects of alleviation thereto. The next section of this paper introduces Queensland local government in the context of the key elements of this study: climate change and tropical cyclones, emergent risk and current and potential risk transfer arrangements. Methods applied to, results, and discussion of the studies are subsequently presented with a conclusion and considerations for further investigation.

2. Context - Queensland coastal local government

2.1. Vulnerability and capacity to address climate change

Over 85% of Queensland's current population (3.8 million) live within 50 km of the coast (Department of Environment and Resource Management (DERM, 2011). This number is expected to significantly increase as a recipient of a majority of a projected state-wide population growth of 50% by 2031[1] (Queensland Treasury, 2011).The majority of these settlements have been established on flood plains (Wenger et al., 2012) with large numbers of people, essential services and facilities in cities such as Cairns and the Gold Coast located on low lying ground (Helman et al., 2010).The extent of infrastructure that has developed in accordance with this demographic is significant (e.g. see Department of Climate Change (DCC, 2009; Zeppel, 2011). The proximity of Queensland settlement and infrastructure to the coast significantly exposes it to climate events such as tropical cyclones and sea level rise (SLR).

Tropical Cyclones are a common feature of the Queensland coast. Associated with high winds, torrential rainfall and storm surges, they have inflicted significant historical damage: e.g. in 2011 Cyclone Yasi crossed the Queensland coast at a relatively sparsely developed area causing over AUD1.3 billion in damage (Shearer et al., 2013).Should they track further south as predicted (Abbs, 2012) cyclones could represent a significant risk to the more densely populated area ofSouth East Queensland. Heavy rainfall is also a common Queensland feature with at times, as illustrated by the 2010/11 floods, dramatic consequence. These floods resultedin three quarters of the state declared a disaster, affecting over 2.5 million people with 33 fatalities and in excess of AUD5.0 billion in direct damages (Holmes, 2012). SLR is expected to exacerbate the impacts of coastal hazards with even minor rises in sea levels creating disproportionate increases in impact (ACECRC, 2008).

International and domestic institutions emphasise local government's optimum position to contribute significantly to coastal challenges such as those faced by Queensland (House of Representatives Standing Committee on Climate Change, Water Environment and the Arts (HRSCCC, 2009; Doran, 2011).However, the capacity of local government to do so may not reflect expectations (Baker et al., 2012). In Australia, a lack of constitutional recognition means that local governments exist as an arm of the country's state governments (Thomas, 2010), which limits policy instrument and funding options (Althaus et al., 2012). Local governments require approval for all local planning schemes in accordance with state planning policy (Nalau et al., 2015) and are exposed to state prioritisation in decision making (Wild River, 2006). Additionally, as Australia's poorest form of government (PricewaterhouseCoopers, 2006) local governments are dependent on a limited pool of local property taxes and state allocated funding to meet a broadening range of responsibilities (Queensland Government, 2009). In the context of climate change there is an expectation amongst coastal councils that significant additional resource will be required from other levels of government to enable them to adapt (House of Representatives Standing Committee on Climate Change, Water Environment and the Arts (HRSCCC, 2009).

2.2. Emergent risk

The Intergovernmental Panel on Climate Change (IPCC) defines emergent risk as "*a risk that arises from the interaction of phenomena in a complex system*" (Oppenheimer et al., 2014, p. 10). It also notes that this complexity may perpetuate along any number of potential interactions from both climate and non-climate drivers. Impacts may arise indirectly or remotely from an initial stress or perturbation, and/or act to compound existing or novel factors, that in some cases generate new risks and in others significantly shifting current risks into new paradigms (Preston and Stafford-Smith, 2009). Although a lack of historical data and/or an understanding of the magnitude of potential impact may impair quantification of emergent risk, attempts of identification will potentially reduce unexpected surprises and better enable adaptation to an ever-fluctuating risk landscape (Guy Carpenter, 2013; Oppenheimer et al., 2014).

Drawing on a baseline of four papers[2], Edwards (2014) derived a typology of emergent risk specific to Local Government (Table1). The typology recognises that councils are not only vulnerable to climate change by way of the physical assets and services they manage on

[1] This equates to 6.6 million under medium growth scenario.

[2] Burton and Dredge (2007); Gurran et al. (2008); Miles et al. (2008); and Burton (2013).

Table 1
Typology of emergent risk (Edwards, 2014, p. 57: Table 14).

Risk	Emergent Characteristics
Health	• Risk of reduction in quality and resilience of human health due to: ○ Change in community demographics; and/or ○ Any degradation in quality and/or lack of access to ecological and anthropogenic services. • Examples include increased prevalence of vector borne disease due to increases in standing water and loss of place due to a requirement to migrate from place of birth.
Environment	• Risk of reduction in form and function of natural systems due to: ○ Change in form and function of inter-related natural systems; and/or ○ Changes in anthropogenic environmental management practice. • Examples include increased coastal erosion due to loss of protection from inshore reefs, reduction in water quality due to seawater inundation.
Infrastructure	• Risk of reduction of ongoing functionality and viability of council managed structures due to: ○ A reduction in capacity of infrastructure to satisfy local community demand as required; and/or ○ Changes in relevance of infrastructure to local communities. • Infrastructure includes managed assets such as roads, buildings and improved land like recreational parks. • Relevance may be lost where functionality is no longer required, e.g. abandonment of a road due to destination failure or loss. Capacity may decrease either due to an increase in demand or a loss of function. Function may be lost where infrastructure is not maintained or is damaged and not repaired.
Operational	• Risk of reduction of ability to meet community requirements either due to: ○ A change in community requirements; and/or ○ A reduction in LGA operational capacity. • Similar to infrastructure risk operational risk can arise indirectly due to service difficulties arising from such factors as reduction in infrastructure functionality, staff availability and access to operational funding.
Policy and Regulation	• Effect of climate change policy and regulation on operations. This may evolve where higher forms of government look to motivate mitigation and adaptive practice to the detriment of others, e.g. carbon pricing may orphan infrastructure due to increased running costs and increased greenhouse gas reporting requirements may increase compliance costs.
Financial - legal	• Risk that council will be subjected to legal action due to perceived or real failure to meet requisite climate change related responsibilities. • Note that this risk refers both to financial implications related to successful actions against council and due to resource tied up in the process itself, regardless of result.
Financial - funding	• Risk that council may not be able to access funding requisite to meet responsibilities and service local community needs. • This may perpetuate through degradation in credit rating or inadequacy of funding sources as a result of erosion of income base (e.g. rates) due to population and local business and agriculture decay, reduced real estate value, loss of jobs etc.
Financial - insurance	• Financial risks to councils as a result of underinsurance, due to either deliberate or accidental partial contractual engagement or unavailability of insurance. • Unavailability may occur due to insurance unaffordability or lack of an insurance industry market. • Partial contractual engagement may occur where extent of risks are misunderstood, misrepresented or deliberately accepted.
Community and Lifestyle	• Risk of a change in standard of living and quality of life. This may arise due to degradation in quality of environmental and societal services, an increased cost of living, loss of sense of community and changing community attitudes and a reduction in economic prospects, i.e. business and employment opportunities.

society's behalf, but also by way of their exposure to society should they not exercise that responsibility to a requisite degree. Table 1 reflects this relationship through recognition of the emergent properties of the linkages that exist between councils and the socio-economic and ecological systems that comprise the coast.

The typology highlights the iterative and inter-related nature of climate change risk, and propensity for impacts, such as legal action and reduced debt access, to emerge subsequent to, yet far removed from, initial physical impacts. A salient example of a risk emerging worldwide due to climate change is that of legal risk. This has particular relevance to Queensland, where a lack of clear coastal development guidance in the face of climate change has created an environment of uncertainty with legal and operational implications for local government (Macintosh et al., 2013; Bell and Baker-Jones, 2014). Beyond the financial impacts of defending decisions both failing to approve development and conversely acting to do so (Bell, 2014), the risk of burdensome legal costs coupled with legal uncertainty could result in legal expedience favoured over effective adaptation action (Macintosh et al., 2013), potentially resulting in maladaptation and stymying proactive decision-making (McDonald as cited in House of Representatives Standing Committee on Climate Change, 2009).

2.3. Insurance and disaster compensation arrangements

Each council in Queensland is responsible for organising its own coverage of non-road assets (typically industrial special risk (ISR) policies that cover replacement, fire and peril relevant to a council's asset register). The City of Gold Coast has opted to provide this insurance via a captive entity (Dollery et al., 2007) whilst all councils interviewed as part of this paper arranged commercial insurance via a broker. Commercial insurance available is limited by particular hazard with coverage offered for acts of the sea such as storm surge and SLR extremely limited (2009; Bell, 2014). The road and bridge network that represents local government's most significant asset exposed to natural disasters is uninsurable (Local Government Association of Queensland (LGAQ, 2014). An attempt by the Queensland Government in 2011 to secure commercial insurance for the State's road network failed with re-insurers simply declining to quote (KPMG, 2012). Legal liability and tailored coverage such as effluent discharge is provided by the Queensland Local Government Mutual Liability Pool (LGM) (Commonwealth of Australia: Department of Finance and Deregulation (DFD, 2012).

In Queensland, the primary mechanism utilised to fund disaster relief is the National Disaster Relief Recovery Arrangements (NDDRA). The NDDRA is joint-funded by both the federal and Queensland governments with the former typically contributing 75% and the latter 25% funding (Queensland Reconstruction Authority, 2019). Relief includes amongst other things, public infrastructure and essential services restoration (House of Representatives Standing Committee on Climate Change, Water Environment and the Arts (HRSCCC, 2009; Bell, 2014). The NDDRA is an essential element of road recovery in Queensland (Local Government Association of Queensland (LGAQ, 2014). Support for Queensland from the NDRRA has been substantial with, for example, NDRRA funding meeting 71% of eligible expenditure in 2011 (KPMG, 2012).

Table 2
Examples of Alternative Risk Transfer Mechanisms (unless specifically stated based on Villegas et al. (2012)).

Alternative Carriers	Alternative Products
• **Captives:** Where policy holders retain control of insurance entity (Salve and Simpson, 2011); • **Pools:** where entities pool their disaster risk with other entities with the objective of sharing risk (Hofman and Brukoff, 2006);	• **Multi-line products:** A bundle of several risks under one policy; • **Multi-trigger products**: Trigger payment contingent on more than one event; • **Contingent capital products:** That allow an insurance company (or other organisation) to raise debt or equity capital at a predetermined price in the event of a severe catastrophic event; • **Insurance linked securities:** Risks are bundled to the capital markets.

2.4. Alternative risk transfer mechanisms

Developed as alternatives to conventional insurance (Salve and Simpson, 2011), alternative risk transfer mechanisms (ARTs) embrace risk transfer via two segments: alternative carriers and alternative products (Swiss Re, 2003). Alternative carriers enable entities to manage their own risk, whilst alternative products provide an innovation of design that often merges traditional insurance features with those of financial products (Villegas et al., 2012) (Table 2).

As noted above, insurance pools (e.g. LGM) and captives (City of Gold Coast) are currently applied by Queensland local government. The self-insurance implicit in these mechanisms provides a number of advantages and disadvantages (Table 3).

Alternative products offer two significant innovations compared to traditional insurance. First is the parametric trigger. Unlike traditional insurance, which indemnifies actual incurred damages, products that utilise parametric triggers pay out on the occurrence of an event. Benefits of parametric products such as promptness of payment and relative simplicity and transparency, are tempered by concerns of basis risk, i.e. that insurance will not cover actual losses. Grove (2012) also cautions that a delinking of payout from loss may tempt political allocation of funds away from much needed repairs. Second, alternative products known as insurance linked securities (ILS) enable the securitisation and distribution of risk to the capital markets. This provides both advantages and disadvantages, some of which are detailed in Table 4. ILS have proven particularly popular with the capital markets, outstripping traditional reinsurance growth in 2015 to reach $69 billion capital (Aon Benfield, 2016). The most popular form of ILS is the catastrophe bond although other products exist for example parametric insurance that incorporates instruments such as weather derivatives (Productivity Commission, 2012). Edwards et al (2018) found no legal impediment to the application of catastrophe bonds by councils located in Queensland.

Limited analysis to date (e.g. see McAneney et al., 2013) indicates that overall market transference may come at significant cost compared to traditional insurance. Such comparison may not however be valid as arguably the greatest advantage that market transfer represents for entities such as local government is the potential to cover risks, such as roads, considered by insurers to be too large and complex to insure (Salve and Simpson, 2011).

3. Methods

The results presented in this paper are part of a broader study to understand local government risk management strategies targeted at emergent risk, in particular loss of access to insurance, and potential of ART to fill an insurance gap. A typology of emergent risk and the potential application of ART to Queensland councils were applied as a baseline for a series of case studies by way of interview with Queensland councils.

Interview candidates were recruited with the aid of the state's peak body, the Local Government Association of Queensland (LGAQ) from six local governments with a documented interest in climate change. Such 'interest' was considered important to constructing a case for *bona fide* research and hence access (Denscombe, 2010), due to the political nature of climate change at the time (Readfern, 2012). Semi-structured interviews were conducted with two individual personnel from each agency capable and willing to discuss risk management of climate change emergent and current risk and how this informed council's utilization of risk transfer mechanisms. Discussion was guided along participant understanding of three pre-determined themes: (i) current and emergent risk from tropical cyclones, (ii) risk transfer mechanisms available to manage these risks and (iii) how each guides the risk transfer mechanism selection. The concepts of emergent risk and ART were defined and introduced to participants at the start of each interview.

The interview process followed an approved human research ethics protocol in terms of contacting respondents, and storing data in anonymous form (Griffith University ENV 35 09 HREC). All interviews were audio recorded with main points transcribed (Miles and Huberman, 1994). Qualitative data software, NVivo (V10 for Mac) was used for coding and analysis. Coding was concept-driven: themes identified pre-interview formed the basis of an initial set of free, high level nodes with recognition that amendments and enhancements could occur specific to transcripts (Ritchie et al., 2003). "Constant comparison" method was used whereby inductive reasoning was applied during the analysis to create and enhance categories as the process progressed (Owens, 2012). These categories were then applied to form a set of new high level and hierarchical nodes under which the transcript was organised.

Table 3
Advantages and disadvantages of self-insurance.

Advantage	Disadvantage
• Captives are able to exercise greater control over the extent of insurance and its affordability and form (Salve and Simpson, 2011); • Pooling potentially creates economies of scale and critical mass that enables operational and pricing advantages unavailable to single entities (Hofman and Brukoff, 2006). For example, it is estimated that between 1998 and time of reporting that LGM had undercut consistent traditional insurer coverage by $50mn (LGAQ cited in Dollery et al., 2007).	• A reduction in reserve size due to the buildup of "unused" reserves falling victim to the temptation (e.g. political pressure) to utilise them for other governmental purposes (Michel-Kerjan and Zelenko, 2011; Kunreuther and Heal, 2012); • Occurrence of an early catastrophe or coincident events (e.g. two or more events occurring in quick succession) exposing shortfalls in reserve accumulation (Kunreuther and Heal, 2012); • Public insurance funds raised through an increase in taxes proving politically unpalatable (Michel-Kerjan and Zelenko, 2011). • Set-up and running costs of entities such as captives dictate a minimum critical mass for economic viability whilst the complexity of the operation demands both a supply of relevant expertise and regulatory supervision (Salve and Simpson, 2011).

Table 4
Comparison of risk transference to capital market relative to traditional insurer (unless specifically noted based on Hofman and Brukoff (2006).

Factor	Comparison
Price Volatility	**Advantage to Markets** as they generate less price volatility: ● Insurance capacity of insurers is very sensitive to big losses due to predominantly impact on capital reserves that drives price spikes (Hofman and Brukoff, 2006); ● Insurers and reinsurers tend to issue policies for one year when price is re-assessed, while Capital Market instruments like Cat Bonds generally issued for at least three years (Kunreuther and Heal, 2012); ● Longer dated bonds enable longer amortisation of costs (Michel-Kerjan and Morlaye, 2008); ● Unlike insurance lack of price regulation in reinsurance market precludes price stability (Kunreuther and Michel-Kerjan, 2009).
Credit Risk	Generally, **Advantage to Markets** as credit risk is spread across numerous participants or reduced via collateralisation: ● Collateral from Bonds generally invested in equivalent of US Treasury funds thus credit risk is minimised (Kunreuther and Heal, 2012); ● Instance of Cat Bond where collapse of Lehman Brothers exposed parties to credit risk due to collateral held by special purpose vehicle (PwC, 2012); ● Counterparty diversification (PwC, 2012).
Additional Expertise	**Advantage to Insurer** due to increased complexity and potential greater role in transaction: ● May be required to negotiate capital markets and understand insurance risk (Michel-Kerjan and Zelenko, 2011); ● Potentially more difficult to understand and implement ILS than traditional insurance (Michel-Kerjan and Zelenko, 2011).
Insurability	**Advantage to Markets**: ● Potential for ILS to address risks considered by insurance industry to be too large and complex to insure (Salve and Simpson, 2011);
Time for renewal process	**Advantage to Markets:** ● Longer dated ILS contracts avoid more frequent and time consuming annual insurance renewals (Moody, 2012);
Potential Capital	**Advantage to Markets**: ● Capital Market represents a much greater pool of potential capital than any single entity (Ng, 2012).

4. Results

4.1. Appreciation of current and emergent risk

All councils recognised current physical hazards from cyclones. The most predominant physical concern noted was freshwater and saltwater inundation. Proximity and extent of infrastructure to the coast and regional topology were reasons provided for flooding concerns. Two participants expressly mentioned that historical development of urban areas on flood plains rendered their regions susceptible to flooding with communities abutting the coast of greatest concern. One council, that displayed lesser concern than all others, seemed to base their comfort on the preface that “we’re not a Gold Coast or a Sunshine Coast with a lot of infrastructure on the water’s edge”.

All participants displayed relative comfort with high wind hazards, citing the effectiveness of building construction standards. Only one participant advised that council constructed beyond regulatory requirements. One participant from a particularly cyclone affected region noted that confidence of little wind damage was based on a recent cyclone that had inflicted only minor damage to buildings constructed according to recent standards. The same person explained that these standards were constantly reviewed and updated based on the work of groups such as James Cook University’s Tropical Cyclone Testing Centre.

The degree of planning undertaken to mitigate risk differed in accordance with proximity to recent disasters: one representative of a hard-hit council noted that due to historical events, cyclones were taken very seriously and planned for accordingly. Another council, far removed from current cyclone activity, noted that little planning had been undertaken for cyclones beyond business as usual.

The future physical impact of climate change informed flood mappings but not building construction. All councils interviewed had either applied an SLR of 0.8 m to coastal mapping or were in the process of doing so. The predominant motivation for incorporation of SLR metrics is to meet legal criteria of a duty of care (see Table 2). In an absence of State government guidance all councils cited legal advice, either sought by council or distributed by the LGAQ based on consultation with their counsel, as a major factor in metric quantification.

All councils indicated at least some consideration of risk that could perpetuate as a result of physical cyclone impacts but varied considerably regarding subsequent action. A number of consistent risks of an emergent nature arose during the discussion, each of which is summarised below (Table 5).

Beyond those noted in Table 5, two participants also raised risks around community fabric and how community interacts with council. Divisiveness and dissatisfaction of community due to failure to meet expectations of relief subsequent to events was cited as a potential risk. One participant cited a redirection of effort away from planned work towards disaster relief as a potential risk, whilst another was concerned about food security after a cyclone. The latter, the researcher was informed, was being actively pursued by the council’s disaster risk management officer.

4.2. Risk transfer mechanisms

Interview participants displayed little to no knowledge of risk transfer mechanisms beyond those utilised directly by councils: (i) traditional insurance (i.e. legal liability covered by LGM and ISR arranged independently through a broker); and (ii) disaster funding mechanisms like the NDRRA to rebuild uninsurable asset, e.g. roads.

The State’s northern councils stated that subsequent to cyclonic activity, only one insurer provided ISR coverage for the region. They perceived that this impacted service levels and premiums paid commensurate with the exploitive power of a monopoly. This caused frustration with one participant noting, concerning the ability to negotiate premiums: “They just set the premiums. What can we do?”

All councils rely on the NDRRA for disaster funding to help rebuild infrastructure. Reliance is substantial for some councils with one participant describing it as a “god send” due to reliance on it to repair uninsurable roads, and another responding: “Oh I don’t know what we would do!” when posed with a scenario of a much reduced NDRRA. Another raised concerns that in such a situation the economy of the region would be severely affected resulting in a “massive impact on us”. A number of participants recognised that NDRRA requirements were becoming more onerous with one council explicitly looking to reduce reliance on the scheme through assumption of damages into operations budgets.

4.3. Mechanism selection process

Beyond the insurance mechanism and insurance pools such as the LGM no participant had been exposed to, or had any knowledge of, alternatives to insurance. One participant remarked that with NDRRA rule tightening such instruments might be useful in closing an emerging insurance gap. This was tempered with an assertion that such instruments would be more applicable at higher government levels and that

Table 5
Types of emergent risk identified by participants.

Legal liability risk	There appeared a strong recognition that to exercise council's duty of care to rate payers, climate change metrics need to be incorporated in planning instruments such as flood maps. There also seemed a relative consensus that the most recent (albeit discontinued) metrics would suffice. There was no indication of any action beyond mapping however, such as maintaining or upgrading infrastructure like drains and pipes to deal with climate change fuelled weather events.
Ability to operate subsequent to a disaster	All councils except one stated that they were undertaking some form of Business Continuity Management (BCM) to ensure operation subsequent to a disaster. In all cases, except for one, participants stated that the design of the process was in its infancy.
Income capacity	Whilst all councils recognised the risk that cyclones represented to future rateable income and local economies none had explicitly modelled potential impact. One particularly cyclone-impacted regional council observed that, a reduction in rate base through a decrease in property valuation and population base, was now a reality. This not only impacted rates income but also levels of state and federal government disaster funding as rates levels determine funding levels.

regulation may restrict their adoption. Beyond this remark, participants' lack of exposure to, and appreciation of, ART was reflected in the little comment received in relation to the introduction of these instruments beyond a perplexed sounding: "oh, interesting".

A common sentiment amongst participants was that the natural pathway they would expect to hear about ART would be via their insurance brokers. In this regard, participants indicated a reliance on insurance brokers, as specialists, to aid them in the selection of insurance. Varying degrees of satisfaction and collaboration with brokers was noted. Most participants suggested a strong collaborative relationship, which resulted in a broker appreciation of risks relevant to each region. Only one indicated that this was not the case and that they were soon tendering for other brokers. Two of the councils had engaged a broker based on the perception that it was considering establishing a local government pool that could provide an ISR alternative[3] . Beyond this however, when asked explicitly whether brokers had advised alternatives to insurance every response was negative. Although there was evidence that councils change brokers on a regular basis many are limited, due to their location, to only one insurer.

Within the confines of current ISR policies two councils noted that they had undertaken, or were in the process of working with brokers to adjust excess levels to reduce premiums. One council was reviewing both the extent and value of insurable assets having already determined that a number would not be insured. In both cases increase in premium costs was the driver for review. All councils except one have seen a significant increase in premiums. Spikes in premiums subsequent to cyclones have also occurred. The exception to this was the southernmost council interviewed that noted consumer price index increases in insurance only. Predominantly LGM premiums for all councils have remained stable.

5. Discussion

Whilst identification by participants of storm surges and floodwater inundation as the greatest cyclone risk is consistent with the literature (e.g. see Webster (2008)), it is arguable that faith in current building codes to mitigate future wind risk is misplaced. A draft discussion paper, relevant to review of the Building Code of Australia, reports that a recommendation in 2012 to increase construction stringency in cyclone zones and amend zone boundaries has been squashed due to insufficient information and justification (Australian Building Codes Board (ABCB, 2014). This leaves the code, amongst other things, deficient of provisions that incorporate wind speed changes related to climate change (Department of Climate Change (DCC, 2009). The now defunct Department for Climate Change and Energy Efficiency (as cited in Shearer et al. (2013)) notes that even in the event of an amendment, reflection in building stock is delayed due to the significant lag between adoption and industry implementation.

Additionally, the adoption of SLR of 0.8 m in planning instruments potentially exposes councils to the risk of litigation they are seeking to reduce. The predominant reason provided for selection of this metric is not that it represents best available science but that it was the latest guidance provided by State. Given the lack of guidance and infiltration of ideology into climate change policy in Queensland at the time of this study (Bell and Baker-Jones, 2014) best available science need not equate to State guidance. Such an approach potentially fails legal advice received by the LGAQ that in part-summary states:

> To limit potential liability, councils should adopt a sea level rise factor that conforms with the International Panel on Climate Change and obtain suitably qualified expert opinion as the effect of applying that factor to their region, having regard for local conditions (de Wit, 2014).

There seemed little appreciation amongst interviewees that not only is the State figure based on a redundant IPCC assessment but that it represents a global average and as such may materially differ from regional projections. Additionally, it is understated compared to other recent prominent analysis of Australian coastal hazards that have applied a more conservative 1.1 m SLR (see Department of Climate Change (DCC, 2009; DCCEE, 2011).

Almost zero tangible attention has been applied to other emergent risk. Even in councils that have recently experienced materialisation of emergent risk, such as reduction in employment opportunities and loss of industry due to cyclone activity, little reflection appears to have been applied to the ramifications of such measures or the probability of further and more intense cyclones. This is particularly apparent with respect to ISR insurance coverage. Reduction in insurers willing to cover ISR in some regions, and a clear increasing trend of premium price in most councils is associated with a spate of cyclones and other extreme weather events. Such developments are consistent with theoretical expectations asserted by authors such as Mills (2009) and Kousky and Cooke (2012). They predict under-insurance as the impacts from extreme weather events become more acute through not only more intense hazards but also additional development placed in harm's way.

Under-insurance is already a reality for some councils who, due to price pressures, have increased their insurance excess or expressly omitted assets from insurance policies. Roads are uninsurable in Queensland with no interest shown by insurers to provide cover. Given projections that cyclones will intensify and move further south it would seem prudent for all Queensland councils to consider access of insurance as an emergent risk. Couple this with a Productivity Commission inquiry into natural disaster funding arrangements, that could very readily result in reduced LGA access to funding, and such a view becomes even more compelling (see Productivity Commission, 2014).

Given their specialised nature and the absence of any broker consideration, the lack of knowledge that participants displayed of ART is hardly surprising. A willingness to engage a broker due to its possible part in establishing a future ISR pool (subsequently formed as LGM Assets) indicates an appetite to explore alternatives however. Potentially this has arisen from the LGAQ's legal liability insurance

[3] Subsequent to these interviews, LGM Assets was formed "*for the sole purpose of benefiting Queensland Local Government by providing effective and appropriate cover for Members' assets based risk exposures*" (Jardines Lloyd Thompson, 2018).

pool, LGM, that has predominantly lived up to theoretical expectations of stable, cheaper premiums across its lifetime.

Recognition from government agencies and initiatives (e.g. Commonwealth of Australia: Department of Finance and Deregulation (DFD, 2012); Productivity Commission (2012)) of the potential of ART, such as parametric insurance, to cover roads indicates awareness within Federal Government of such instruments, and their potential to insure the uninsurable. However, no State has undertaken a cost-benefit analysis of the feasibility of ART, citing perceived cost as a major barrier to such an exercise (KPMG, 2012). State Government procrastination, coupled with the relative novelty of such instruments in Australia and the expertise required to utilise them, have doubtlessly contributed to ART's invisibility to Queensland councils. Equally as perplexing is a failure of brokers, and by association, insurers to engage councils about ART. This could represent an undeveloped business opportunity or simply mean that ART is not considered appropriate. Similar to a study undertaken by Johannsdottir et al. (2014), the answer is not apparent.

The LGM pool represents the only mechanism considered beyond traditional insurance. The pool however was established not in response to potential legal liabilities from climate change but as a result of the "*veritable explosion in liability litigation against councils*" that arose in Australia during the 1990s (Dollery et al., 2007, p. 9). Whether levels of insurance determined under such circumstances are enough to sustainably cover the magnitude of damages that may ensue from the potentially extensive impacts of catastrophic weather events has not been explored. Certainly, in the short-term, utilisation of an insurance pool has accrued benefits consistent with a body of literature, that has found that insurance pools provide stable and cost-effective premiums to their members.

Concerning commercial insurers and ISR the decision for some councils is not so much which insurance to engage as how to tweak it to make it affordable. An increase in the adoption of self-risk in a number of circumstances, either by increases in excess or exclusion of certain items from policies, indicates that insurance is becoming less economically viable. The main drivers here appear to be historical extreme weather events, not projected or emerging. Consistent with residential insurance (e.g. Shearer et al., 2013), premium costs rose dramatically subsequent to cyclone activity and not in anticipation of it. A lack of dialogue about projected climate change risk instigated by either ISR brokers or the council is evident. Minimal engagement in this area is consistent with research from the USA that found of 183 insurers surveyed only 23 had comprehensive climate change risk strategies (Leurig and Dlugolecki, 2013). Additionally, despite announcements by reinsurers like Lloyds (2014) concerning integration of climate change into risk assessment, recent research indicates that these risks are significantly underestimated (Insurance Business Organisation (IBO, 2014).

6. Conclusion

This study has clearly shown that councils have currently little understanding about emergent risk from climate change specific to tropical cyclones, and by association any implications this represents for risk transfer mechanisms. Even where emergent risk is considered, it is arguable that measures taken fall short of those required to manage risk to reasonable levels. The viability of insurance as a sustainable risk management tool and the implications of lost access received little attention. Conversely, ART, in its capacity as an insurance gap filler is effectively invisible. Despite a growing body of research showing that it is in the insurance industry's own interest to reduce climate change risk, and that the industry has the tools to do so, interviews provided very little evidence of such behaviour. The heavy reliance and expectation that the NDRRA will always prevail may also act as a barrier to market-based mechanisms.

At this point it would be remiss to be too critical of local government. Whilst the results of this research highlight a number of potential shortfalls in local government risk management and governance practice, they are also indicative of local governments worldwide and the public and private agencies who service and govern them, who are all grappling to deal with the paradigm shift that climate change creates. Indeed, given the specialised nature of the issues discussed herein, it is arguable that the most significant driver of local government shortfalls is public and private agency guidance. Beyond the building codes and sea level rise factors adopted from government policy, this "immaturity of advice" is most inherent in the dearth of exposure of local government officers to the concepts of emergent risk and ART. A very clear theme of this research is a reliance on insurance brokers to aid in both risk identification and transfer. Yet interviewees noted that brokers neither recommended alternative risk transfer mechanisms nor engaged councils on emergent risk from climate change. Given their central role in this process, further research should investigate brokers' and by association insurers' lack of engagement in this area. As an exploratory study on an emerging problem area, a natural next step would also be to increase the scope of councils to a quantity more statistically representative and beyond that based on the coast. Such scope could also extend beyond developed countries to the least developed countries to further explore insurance and ART's contextual role in climate change adaptation.

Acknowledgements

The authors would like to thank reviewers for their constructive feedback on an earlier version of the manuscript, and also the research participants for contributing to this study with their insights. All omissions are the authors' sole responsibility.

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